Citation:

Newby PK, Peterson KE, Berkey CS, Leppert J, Willett WC, Colditz GA. Dietary composition and weight change among low-income preschool children. *Arch Pediatr Adolesc Med.* August 2003;157(8):759-64.

PubMed ID: 12912781

Study Design:

Cohort study (longitudinal, prospective)

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the relationship between dietary composition and weight change among children. Tested several hypotheses considering intake of nutrients (total fat and fiber) and predefined food groups (breads and grains, "fat foods," fruits and vegetables) used in the North Dakota Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Inclusion Criteria:

- *At risk of overweight:* BMI of at least the 85th percentile.

Exclusion Criteria:

- Participants with only one clinic visit.
- Participants with biologically implausible measures of weight for height, weight for age or height for age or children who were underweight (below the fifth percentile).
- Participants who had an implausible change in BMI (a reduction or increase in BMI=4).
- Participants for which the second visit was less than six months or more than 12 months from the first.

Description of Study Protocol:

Recruitment

- North Dakota WIC participants with two visits six to 12 months apart (if more than two visits, the study used the first two).

Design

- Measurement of height and weight. WIC records provided socioeconomic data on birth weight, years of maternal education, race and ethnicity, residence and federal poverty level.
- Dietary data were collected using a semiquantitative food frequency questionnaire (84 foods, based on most common food sources; consumption categories were created on the basis of median portion sizes for low-income women and children, as reported in the 1985 CSFII). Food group scheme was developed by a nutrition committee, consisting of representatives from several statewide WIC programs and academic experts at the beginning of the project in 1992. Age, weight and total energy intake were taken at baseline.

Statistical Analysis

- Linear regression analysis (estimate associations of diet with weight change).

Data Collection Summary:

Timing of Measurements

- Two WIC visits that were six to 12 months apart.

Dependent Variables

- Change in BMI over time.

Independent Variables

- Dietary intake (*Food group scheme:* Breads and grains, fat foods, fruits, vegetables).

Control Variables

- Sex
- Baseline age
- Weight
- Total energy intake
- Change in height during the time interval
- Birthweight
- Maternal education
- Race and ethnicity
- Residence
- Poverty level.

Description of Actual Data Sample:

Initial N

- 17,232.

Attrition (final N)

- 1,379.

Age

- Two to five years old.

Ethnicity

- *Girls:* White 84%, Native American 10%, African-American 2%, Hispanic 3%, Asian 1%
- *Boys:* White 83%, Native American 12%, African-American 2%, Hispanic 2%, Asian 1%.

SES

- Poverty level
  Girls: <100% (58%), 100-133% (20%), >133-185% (24%)
  Boys: <100% (54%), 100-133% (24%), >133-185% (23%).

Anthropometrics

- At baseline, 18% of girls and 23% of boys were at risk of overweight.

Location

- North Dakota, USA.

Summary of Results:

Multivariate Model

- In multivariate, energy-adjusted models, the following was observed:
  - A 0.19 kg *lower* weight change per year (CI -0.22 to -0.15 kg, P<0.001) with each additional serving of breads and grains
  - A 0.07 kg *greater* weight change per year (CI 0.03 to 0.11 kg, P=0.003) for each additional serving of fat foods
  - A 0.09 kg *greater* weight change (CI 0.05 to 0.13 kg, P=0.02) for each additional serving of vegetables.
- *Fat foods included:* Ice cream, mayonnaise, potato chips, cookies, cakes, pie, chocolate, hot dogs, bologna, butter, margarine, fried chicken, fried fish, sausage, donuts, sweet rolls and French fries.
- *Vegetables included:* Corn, peas, tomatoes, peppers, carrots, broccoli, beans, spinach, greens, squash, potatoes, yams, lettuce, cabbage, vegetable soup, mixed vegetables and French fries. French fries are omitted from the analysis.

Single Model

- In all groups as a single model (multivariate adjusted) the following was observed:
  - A 0.16 kg *lower* weight change per year (CI -0.2 to -0.12 kg, P<0.001) with each additional serving of breads and grains
  - A 0.05 kg *greater* weight change per year (CI 0.01 to 0.09 kg, P=0.03) for each additional serving of fat foods.
- Fruit consumption was not significantly related to weight change in any model tested. This finding remained when fruit juices were excluded from the analysis.
- Energy, fiber, carbohydrate and fat (no other nutrients) were examined. Total fat and fiber were not significantly related (P>0.05) to weight change in any of the analyses. Total energy was not independently related to weight change (data not shown). No comment on

carbohydrate.
- Total energy was not independently related to weight change. Total fat (g) and percent fat were not significantly related to weight change (P=0.13 and P=0.14, respectively).
- Vegetable intake was no longer significantly related to weight change.

Author Conclusion:

Intake of fat foods, but not dietary fat per se, was significantly related to weight gain in this study of preschool children. Whereas intake of breads and grains, but not dietary fiber per se, was significantly related to weight loss.

Reviewer Comments:

Strengths

- *Prospective design.*
- *Included all nutrients in one model and all food groups in another model to adjust for potential confounding of dietary predictors.*

Limitations

- *Sample size: Multiple exclusions were performed to create an analytic data set, including restricting the time interval between diet and weight change to a range of six to 12 months.*
- *Dietary intake measured by FFQ was completed by the child's mother.*
- *Dietary intake at visit one may not be a good representation of intake over the entire follow-up period. FFQ only considered the previous month, and does not provide information on total food intake between the two visits.*
- *Inconsistent findings across studies may also be explained by inadequate adjustment for confounders such as parental BMI, sex, birthweight, physical activity and television viewing. Race and ethnicity, income and place of residence have also been associated with obesity. This study adjusted for some, but not all potential confounders (parental BMI and TV viewing).*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes

4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	???
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	???
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	???
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	N/A
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes

7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes